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(PCT Article 36 and Rule 70)

Form PCT/IPEA/409 (cover sheet) (April 2005)

Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:
- ☒ pages _____ as originally filed/furnished
- ☐ pages* _____ received by this Authority on _____
- ☐ pages* _____ received by this Authority on _____
- ☒ the claims:
- ☐ pages _____ as originally filed/furnished
- ☐ pages* _____ as amended (together with any statement) under Article 19
- ☒ pages* 20 to 22 _____ received by this Authority on 29 June 2005 (29-06-2005)
- ☐ pages* _____ received by this Authority on _____
- ☒ the drawings:
- ☒ pages _____ as originally filed/furnished
- ☐ pages* _____ received by this Authority on _____
- ☐ pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	1 to 9	YES
	Claims	none	NO
Inventive step (IS)	Claims	1 to 9	YES
	Claims	none	NO
Industrial applicability (IA)	Claims	1 to 9	YES
	Claims	none	NO

2. Citations and explanations (Rule 70.7)

D1 : US 6,457,451 B1 (SAKITA) 01 October 2002 (01-10-2002)

Claims 1 to 9 are novel and do comply with Article 33(2) of the PCT. Document D1 (US 6,457,451 B1) is considered to be the closest prior art and discloses a rotary piston engine comprising:

- at least one toroidal cylinder disposed within a cylinder housing;
- at least two impellers with diagonally opposed, radial vanes rotatably mounted in the cylinder such that the vanes define four working chambers disposed between adjacent vanes;
- a common drive train consisting of intermeshing, non-circular gears configured to rotate the impellers such that the vanes of the respective impellers cooperate to form the four working chambers; and
- stationary valve means provided for selectively allowing the entry (inlet) or exit (exhaust) of a working medium through the engine; i.e. via passages provided in the cylinder housing.

However, as noted below, the subject matter of each of claims 1 to 9 differ from the prior art by claiming that 'the rotary valve element associated with each impeller rotates with its respective impeller thereby selectively opening and closing passages provided in the cylinder housing, with the passages connecting the working chambers to suitable intake and exhaust means, such that the working media is able to enter and exit the engine'. The present arrangement thus enables each rotary valve element to stay directly connected to the impeller such that the rotary valve element accelerates and decelerates in direct relation with the impeller thereby enabling the impeller vanes to be made smaller, as the vanes themselves are no longer directly responsible for the opening and closing of the input and exhaust ports of the engine.

Furthermore, claims 1 to 9 do possess an inventive step and, therefore, do comply with Article 33(3) of the PCT. The subject matter of each of the aforesaid claims is considered to involve an inventive step since the prior art does not fairly suggest the concept of providing a rotary engine in which 'each rotary valve element stays directly connected to the impeller such that the rotary valve element accelerates and decelerates in direct relation with its associated impeller'.

Finally, the subject matter of each of claims 1 to 9 is considered to be industrially applicable and thus complies with the requirements of Article 33(4) of the PCT.

Box No. VII **Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

Claims

During the examination process, the Examiner noticed a number of clerical or grammatical errors that the applicant may choose to correct. As a courtesy, the following amendments are offered as a means for correcting the aforesaid errors:

1.1 Claim 2, lines 4 and 5 could be amended to read "...gear parameters are defined as a function of minimum vane opening...".

1.2 Claim 6, line 8 could be amended to read "...being riven by a corresponding part of a gear train...".

1.3 Claim 6, lines 10 to 14 could be amended to read "...several toroidal cylinders being interconnected to form a common drive train; wherein said drive train controls a relative position of each of the impellers of those cylinders, thereby determining the relative position of each of said vanes...".

1.4 Claim 9, lines 2 to 5 could be amended to read "...rotates around a focal point and where gear parameters are defined as a function of minimum vane opening allowing a formulation of four chambers in each toroidal cylinder to be positioned planetary to an input / output shaft...".

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. Claim 1 does not meet the requirements of Article 6 PCT in that the matter for which protection is being sought is not clearly defined for the following reason:

1.1 In claim 1, the expression "cylinder housing" (claim 1, lines 7 and 8) lacks a proper antecedent basis.

1.2 In claim 6, the expression "combustion unit" (claim 6, lines 7 and 8) lacks a proper antecedent basis.

1.3 In claim 6, the expression "relative position" (claim 6, line 12) lacks a proper antecedent basis (also identified in section 1.3 of Box No. VII).

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An engine or pump comprising at least one toroidal cylinder, two impellers with radial vanes rotatably mounted in said cylinder with said impellers cooperating with said cylinder to define working chambers between adjacent vanes, each impeller including to one side thereof at least one rotary valve element which rotates with the impeller and selectively opens and closes passages in said cylinder housing to said working chambers for inletting and exhausting a working media; said rotary valve elements cooperating with said housing such that the position of said valve element defines media flow through said engine or pump.

2. An engine or pump as claimed in claim 1 including a drive train having at least two elliptical gears controlling said impellers and wherein each elliptical gear rotates around a focal point and where gear parameters are defined as function of minimum vane opening allowing formation of four chambers in each toroidal cylinder.

3. An engine or pump as claimed in claim 1 and 2 wherein each impeller has two diagonally opposed radial vanes which rotate within a toroidal cylinder of said housing with said four working chambers being defined between said vanes.

4. An engine or pump as claimed in claim 1 to 3 wherein each valve element includes two outwardly extending nodes that cooperate with a valve portion of said housing, said nodes closing ports in said housing to said working chambers as a function of the angular position of said valve elements.

5. An engine or pump as claimed in claim 1 to 3 wherein each valve element has a series of arcuate passages which connect said working chambers with ports in said housing to selectively open and close ports in said housing to said working chambers, each arcuate media passage including a port adjacent a vane of said engine or pump.

6. An engine or pump assembly comprising at least two toroidal cylinders interconnected by a common drive train; each toroidal cylinder having a pair of rotating impellers; each impeller having two diagonally opposed vanes cooperating with vanes of the other impeller to define four working chambers which change in volume as the vanes rotate in said toroidal cylinder; said impellers of each combustion unit being driven by a corresponding part of gear train for controlling the vane movement as a function of the position in said toroidal cylinder with said gear trains of several toroidal cylinders being interconnected to form common drive train; said drive train controlling the relative position of the impellers of those cylinders and thereby determine the relative position of said vanes and wherein said units cooperate by being out of phase with each other in a manner to reduce output variation by complementing each other.

7. An engine as claimed in claim 6 using one toroidal cylinder as a compressor unit driven by said common drive train and providing compressed media to said working chambers of other toroidal cylinders used as combustion units.

8. An engine or pump assembly as claimed in claim 6 wherein said drive train includes at least 6 elliptical gears synchronizing vane positions in two toroidal cylinders, said at least 6 elliptical gears including 3 gears in mesh for one pair of vanes of one unit and one pair of vanes of the other unit, and a further 3 gears in mesh

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for a second pair of vanes in the one unit and a second pair of vanes of the other unit.

9. An engine or pump as claimed in claim 8 wherein each elliptical gear rotates around focal point and where gear parameters are defined as function of minimum vane opening allowing a formulation of four chambers in each toroidal cylinder positioned planetary to input/output shaft of said drive train.